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Reducing individual meat consumption: An integrated phase model approach

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ABSTRACT

The aim of this study is to identify the factors involved in reducing meat consumption. Meat consumption is a major contributor to greenhouse gas (GHG) emissions and thus to climate change. Since meat consumption is a voluntary form of behavior, and since only 1.4 percent of the Swiss population are strict vegetarians, there is considerable potential for behavioral change. We propose an integrated and dynamic model based on a theory of planned behavior and a phase model of behavioral change to identify the factors involved in encouraging behavioral change and to discuss their practical implications. Our findings, based on a representative survey applying a multi-nominal logit approach, suggest that it is mainly attitude, perceived behavioral control, personal norms and problem-awareness that have significant impacts on the phase an individual has reached in a process of behavioral change (pre-decision, pre-action, action and post-action). The theoretical, empirical and practical implications discussed here will increase our understanding of the effectiveness of interventions aimed at reducing meat consumption. This should aid public authorities, policy-makers and marketing professionals in deciding how to promote a meat-reduced diet by choosing the most promising factors for behavioral change.

1. Introduction

Meat consumption is strongly related to environmental impacts. The Food and Agriculture Organization of the United Nations (FAO) estimates that eighteen percent of anthropogenic greenhouse gas emissions can be attributed to the livestock industry, including the meat industry (FAO, 2006). In total, the share of the livestock industry in producing GHG emissions is higher than that of the global transport industry. This situation is mainly due to the fact that, during the last century, meat consumption has increased massively, not only in the developed world, but also in developing countries. In recent years, the consumption of animal-based food products (i.e. meat and milk) has increased twice as much in developing countries than in developed countries (Delgado, Rosegrant, Steinfeld, Ehui, & Courbois, 1999). The demand for livestock products is projected to increase by 70% by 2050, due to the growth in both incomes and world population (Gerber et al., 2013). This global increase in meat consumption contrasts sharply with the growing scientific consensus that limiting or avoiding animal foods is not only more sustainable (e.g. De Boer & Aiking, 2011), but also healthier (e.g. Sabaté, 2003). Reducing meat intake and replacing it with plant-based foods is closely linked to in the task of reducing GHG emissions: that is, a meat-reduced diet (MRD) also contributes to the mitigation of climate change (Hoogland, de Boer, & Boersema, 2005). Specifically, cutting production in the livestock industry by 50% would result in a reduction of 24–40% in GHG emissions (Westhoek et al., 2014). A MRD not only reduces GHG emissions: consumer health would also benefit from a more plant-based diet (Stehfest et al., 2009). For example, cardiovascular diseases (CVD; Bernstein et al., 2010) and different forms of cancer (Eshel & Martin, 2006) are negatively influenced by meat intake. The World Health Organization (2015) recently classified excessive consumption of potentially carcinogenic. In other words, health benefits can be achieved by adopting a more balanced diet, which often means increasing vegetable and fruit intake (e.g. Epstein et al., 2001) and reducing meat consumption (e.g. Pan et al., 2012; Micha, Wallace, & Mozaffarian, 2010).

Against this background, the following question arises: How can more individuals be motivated to reduce their meat intake? We suggest that stage models or, as they are also known, phase models provide a promising approach to identifying interventions in order to motivate people to reduce their meat intake. Phase models provide a theoretical, heuristic and practical framework that helps to segment a population according to its actual behavior and to categorize interventions in accordance with processes of behavioral change (for the energy savings involved, see Ohnmacht, Schaffner, Weibel, & Schad, 2017; Schaffner,

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Ohnmacht, Weibel, & Mahrer, 2017; for a first application, see Heckhausen & Gollwitzer, 1987; Prochaska & DiClemente, 1982). Based on their phase affiliation, people can be targeted with tailored, subgroup-specific interventions that motivate them to move further along the process of behavioral change. Research suggests that identifying consumer subgroups with common characteristics is crucial to developing effective strategies for sustainable food consumption (de Jonge & van Trijp, 2013; Vanhonacker & Verbeke, 2009). For example, declarative knowledge and problem awareness seem to be important processes that can be supported by tailored interventions to initiate a process of behavioral change (Prochaska, DiClemente, & Norcross, 1992; Bamberg, 2012). Tailored interventions could help not only to reduce meat consumption, but also to support national and communal strategies to mitigate climate change. Studies of tailored interventions in different domains of sustainable consumption show that it is crucial to include the characteristics of the targeted subgroup in the intervention design in order to support its success (e.g., Verain, Dagevos, & Antonides, 2015; Hardisty, Johnson, & Weber, 2010; Brög, Erl, Ker, Ryle, & Wall, 2009), thus overcoming the scattergun effect of mass one-size-fits-all interventions.

Little is known about (a) the validity and applicability of the phase model approach in motivating people to reduce meat consumption, nor about (b) the importance of socio-psychological factors (e.g. attitude) within each of these phases. However, there is strong empirical evidence for the importance of socio-psychological factors when predicting people's food consumption. Based on the Theory of Planned Behavior (TPB) and its extensions (Ajzen, 2002; Madden, Ellen, & Ajzen, 1992; Ajzen & Fishbein, 1980; Ajzen, 1991), numerous studies have been conducted supporting the notion that socio-psychological factors predict intentions regarding food choices (e.g. Arvola et al., 2008; Verbeke & Vackier, 2005; Beale & Manstead, 1991; Lloyd, Paisley, & Mela, 1993; Sparks & Shepherd, 1992). TBP proposes that both behavioral intentions and behavior itself are predicted by a persons' attitude (how positive pro-environmental behavior is evaluated), subjective norms (social influences that shape pro-environmental behavior) and perceived behavior control (how easy or difficult it is to demonstrate a certain pro-environmental behavior). In general, in meta-analyses TPB has been shown to have strong predictive power (e.g. Armitage & Conner, 2001). In respect of MRDs, reduction intentions have been shown to be negatively correlated with meat consumption and more specifically to be predictable with reference to attitudes, norms and perceived behavioral control (Zur & Klöckner, 2014).

However, these studies do not incorporate phases, that is, they do not segment the sample into different phase-specific groups. Based on latent structural modeling, Lippke, Nigg, and Maddock (2007) showed that the phases are qualitatively different from each other with regard to the variables of the TPB. Velicer, Prochaska, and Redding (2006) point out the importance of the Transtheoretical Model (TTM) when it comes to tailored interventions for smoking. That is, the individual phase affiliation seems to be a useful segmentation tool for risk intervention. These studies suggest that phase models provide a useful framework with which to segment a population when planning interventions.

The aim of this article is to identify the relevant socio-psychological factors and, using the phase model framework, asking to what extent these factors influence people's willingness to reduce their meat consumption in each phase (see Bamberg, 2012, 2013 for descriptions of the phase model framework). Based on our empirical findings, we identify the practical implications by discussing the factors that encourage behavioral change based on the proposed phase model by suggesting concrete interventions that are linked to the phases.

The remainder of this article is structured as follows. First, we introduce the basic literature on meat consumption, environment and health, followed by a conceptual framework of phase models, in order to link them to the socio-psychological factors that can be addressed by interventions to support behavioral change in the form of reducing meat consumption. Secondly, we analyze empirically the effect of the different socio-psychological factors on reducing meat consumption by using a multinominal logit (MNL) approach (Greene, 2003). Thirdly, we end the article by offering recommendations and discussing the practical implications of the study for intervention design in order to motivate people to reduce meat consumption.

1.1. Meat consumption, environment and health

Private households are in a strong position to mitigate negative environmental and health impacts by changing their nutrition patterns. According to Leitzmann (2014), the main reasons for adopting more plant-based diets are health concerns and ethical, ecological and social issues. One way for consumers to increase the sustainability of their food choices is to reduce their meat consumption (Jungbluth, Tietje, & Scholz, 2000). Since meat consumption as such is a voluntary form of behavior, and since only a small percentage of western societies are vegetarians – e.g. only 1.4 percent of the Swiss population are strict vegetarians (1 percent eat meat or fish less than once a week, and 3 percent eat meat or fish at most once a week; Stamm, Fischer, Wiegand, & Lamprecht, 2017) – the potential for encouraging behavioral change in the direction of a more plant-based diet is high (Zur & Klöckner, 2014). For example, Latvala and colleagues (2012) showed that 39% of consumers intend to adopt a MRD and increase their vegetable intake.

However, meat consumption involves not only intentional, conscious decisions but also automatic and habitual ones (Blake, Bisogni, Sobal, Jastran, & Devine, 2008), which can be triggered by external cues (De Boer, Schösler, & Aiking, 2014), two of which are normative and sensory cues. Normative cues indicate the specifications of an appropriate food intake (e.g. portion size), whereas sensory cues refer to the hedonistic component (e.g. the palatability) of a food item (Herman & Polivy, 2008). According to Herman and Polivy (2008), both normative and sensory cues influence the food intakes of all consumers. In this vein, one normative strategy to motivate people to follow a MRD is to promote the provision of smaller portions of meat (Sutton & Dibb, 2013) or the consumption of "better" meat, such as organic or free-range meat (de Boer, Boersema, & Aiking, 2009).

On the macro-level, factors that reside outside of individual control also influence personal food choice. For example, Thogersen (2010) showed that structural variables that are determined by policy and market agents having a strong impact on the sustainability of individual food consumption. For example, political measures like subsidies for the meat industry or cultural factors affect personal food choices. With regard to meat consumption, cultural factors seem particularly important. In western cultures, meat still plays an important role in food culture (Latvala et al., 2012). One of the reasons for this is the stress on meat as central to the content of a meal, as in the idea that it should consist of one piece of meat and two pieces of vegetables (Schösler, De Boer, & Boersema, 2012). Until 2016 in Swiss television and print ads, meat was promoted by the Swiss meat industry as the single most important part of a meal, as "everything else is a side dish" (Renz, 2015). Although many consumers seem to be willing to change their behavior, a major proportion are not (Latvala et al., 2012).

1.2. Conceptual framework

Due to its empirical proof of concept and clear theoretical structure, we will adopt the Self-Regulation Model as a framework, as also found in the work of Bamberg (2012, 2013). The Self-Regulation Model provides a conceptual framework for the systematic integration of socio-psychological factors based on the TPB to explain affiliations to specific phases. The phases themselves will be operationalized based on reduced meat consumption. These phases and their associated socio-psychological factors can in turn be addressed by an appropriate and suitable intervention to promote a MRD.

1.2.1. Self-regulation model

Psychological phase models explain behavioral change as a linear process consisting of different phases (Prochaska & DiClemente, 1982; Heckhausen & Gollwitzer, 1987). These models integrate the dynamic nature of human behavior by accounting for the procedural character of behavioral change. Furthermore, phase models set out a decisional basis in order to deliver the right interventions at the right time by dividing the population into different segments based on their behavior. A meta-analysis showed that tailored interventions that were matched to the phases of change produced better results than general interventions (Noar, Benac, & Harris, 2007). Some studies have shown the effectiveness of tailored interventions in the fields of energy consumption as well (Bamberg, Hunecke, & Blöbaum, 2007). Recently, a number of studies have applied phase models of behavioral change in examining pro-environmental behavior (e.g. Martens & Rost, 1998; He, Greenberg, & Huang, 2010; Bamberg, 2012, 2013) and food consumption (e.g. De Vet, de Nooijer, de Vries, & Brug, 2006; Wiedemann et al., 2009; Schwarzer et al., 2016; Fleig, Küper, Lippke, Schwarzer, & Wiedemann, 2015; Zeidan, Partridge, Balestracci, & Allman-Farinelli, 2018). In general, these studies enhance our understanding of pro-environmental behavior by incorporating the procedural aspects of behavior change. However, only a few studies examine the impact of socio-psychological factors in each phase separately. Wiedemann et al. (2009) showed that self-efficacy was associated with phase progression in all phases (form preintention to action). In the same vein, De Vet et al. (2006) illustrated that self-efficiency was an important predictor for forward phase transitions.

The Self-Regulation Model (Bamberg, 2007; Bamberg, 2013) includes four phases between goal-setting and goal achievement: the predecisional action phase (1), the pre-actional phase (2), the actional phase (3) and the post-actional phase (4). This model also includes relevant components of the Theory of Planned Behavior (TPB), as well as the normative and emotional aspects of pro-environmental behavior. Bamberg (2013) applied this new approach to the transportation industry, and his results from this study were used to support our hypotheses.

During the pre-decisional phase (1), the main psychological task is to re-evaluate actual behavior. The aim is to motivate people to consider the individual and collective disadvantages of their actual behavior and to form a binding goal intention, for example, through activation of a “be” goal. The formulation of an appropriate “be” goal could proceed as follows: “I want to be ecologically responsible by changing my nutritional habits”. In the pre-actional phase (2), an individual’s task is to select a new behavioral strategy and form a goal intention. The formation of the respective behavioral intention as a “do” goal marks the completion of the pre-actional phase (e.g., “In the future I intend to eat less meat”). The psychological task of the actional phase (3) is to prepare for implementation of the behavioral intention (Gollwitzer, 1999). To do that, the individual has to define precisely which activity is to be performed when and how (“motor control” goal, e.g., “I will consume meat only once a week”). Implementation represents the completion of the third phase and the transfer to the fourth phase. In the post-actional phase (4), when the new behavior has been implemented, the task is to avoid regressing to former behavioral patterns and thus to previous phases (e.g., “I will consume less meat consistently, even though from time to time I might feel tempted not to do so”). The individual’s aim is to reach a habituation or automatic activation of the new, desired behavior.

1.2.2. Theory of planned behavior

The TPB (Ajzen, 1991, 2002) is a popular approach to explaining environmental behavior and behavioral change (Liebe, Preisendörfer, & Meyerhoff, 2011). It has therefore been extensively studied in the context of pro-environmental behavior (for reviews, see Steg & Vlek, 2009; Bamberg & Möser, 2007; Wall, Devine-Wright, & Mill, 2007). For example, Arvola and colleagues (2008) showed that attitudes and moral and subjective norms are predictive with regard to pro-environmental food choices. Similarly, the intention to eat fish was positively related to attitudes towards eating fish, subjective norms and PBC (Verbeke & Vackier, 2005). The aim of the theory is to detect the causal mechanism behind a behavioral intention. The TPB is based on the assumption that behavior is the result of a particular conscious behavioral intention. Since TBP postulates that people are motivated by self-interest and decide rationally (Steg & Vlek, 2009), the theory has been criticized for its limitations by ignoring emotional and value-based factors (Harland, Staats, & Wilke, 1999; Kaiser & Gutscher, 2003). As a result, it has been proposed to include emotions, personal norms (i.e. values) and problem awareness in predicting pro-environmental behavior (Bamberg & Möser, 2007). Thus, in addition to the classic predictors of TPB, namely attitude, perceived behavioral control and social norm, the predictors emotion, personal norm and problem awareness are included in the model.

On the micro-level, one of the main factors influencing the behavioral intention to execute the target behavior are *attitudes* towards specific forms of behavior, including alternative forms of behavior. The factor attitude measures the anticipated instrumental and emotional consequences of behavior.

Social norms are acquired through social learning from social reference groups that produce standards for what is viewed as right or wrong. For example, social norms are formed by socially significant others who either support the idea of a MRD or not.

Perceived behavioral control (PBC) is understood as people's perceptions of the difficulties of performing a given behavior, such as reducing meat consumption. It is associated with beliefs about the presence of factors that may facilitate or impede performance of the behavior (Ajzen, 1991).

A *personal norm* is the individual conviction that acting in a certain way is right or wrong (Bamberg & Möser, 2007; Bamberg et al., 2007; Hunecke, Haustein, Böhler, & Grischkat, 2010), for example, that reducing meat consumption can be perceived as morally desirable. It has been demonstrated that personal norms are positively correlated with pro-environmental behavior (Bamberg & Möser, 2007).

Anticipated *emotions* are defined as anticipating future positive and negative emotions that suggest a mechanism by which emotional processes can guide (or bias) behavior, particularly decision-making. People change their goal intentions based on the emotions they experience (Schwarz, 1990). Negative emotions towards an actual form of behavior, such as meat consumption, can be understood as goal-incongruent emotions such as anger, anxiety, disgust and so forth. In the context of pro-environmental behavior, communication strategies are usually designed to evoke negative moral emotions such as guilt, fear, anxiety and worry (Van der Linden, 2014). Recently, it has been suggested that positive and negative emotions influence pro-environmental behavior. Whereas negative moral emotions, such as guilt, are triggered by becoming aware of the negative consequences of environmentally unfriendly behavior, acting congruently with personal moral norms elicits positive emotions, such as pride (Schwartz & Howard, 1981; Bamberg, 2013). Both emotions influence pro-environmental behavior (Schaffner, Demarmels, & Juttner, 2015).

Perceived negative behavioral consequences can be affected by declarative knowledge, as this raises *problem-awareness* (e.g., “What would happen to CO_2 emissions if people from developing countries ate as much meat as people from developed countries?”). Environmental awareness means understanding the fragility of our environment and the importance of its protection by rethinking our own consumption behavior (e.g. meat consumption).

1.3. Hypotheses

Based on Prochaska et al. (1992), the main drivers of behavior change, as described above, can be divided into cognitive and behavioral factors, which both have specific influences in each phase.

Table 1
Operationalization of concepts: survey questions and measurement.

Focus	Measurement level and type
Dependent variable	
Phase model	Four phases (self-reported items)
Socio-demographic variables	
Gender	Nominal (male, female)
Age	Nominal – five categories (18–25, 26–40, 41–55, 56–69, 70 and older)
Education	Nominal – three categories (primary, secondary, postsecondary)
Socio-psychological factors	
Attitude	Ratio (mean-index consisting of two ordinal five-point Likert scales treated as equidistant), Cronbach's alpha = 0.92, M = 3.64, SD = 1.21 *Reducing my meat consumption is…* **Q1**: un*pleasant* (1), *pleasant* (5) **Q2**: *bad* (1), *good* (5)
Social Norm	Ratio (1 ordinal five-point Likert scale treated as equidistant), M = 3.10, SD = 1.43 **Q1**: *Most people who are important to me would support me if I were to reduce my meat consumption – disagree (1) to agree (5)*
Perceived Behavior Control (PBC)	Ratio (mean-index consisting out of 2 ordinal five-point Likert scale treated as equidistant), Cronbach's alpha = 0.88, M = 3.84, SD = 1.24 *Reducing my meat consumption is…* **Q1:** *difficult* (1), *easy* (5) **Q2:** im*practical* (1), *practical* (5)
Personal Norm	Ratio (1 ordinal five-point Likert scale treated as equidistant), M = 3.18, SD = 1.53 **Q1:** *I have made it one of my personal principles not eat a lot of meat – disagree (1) to agree (5)*
Emotion	Ratio (mean-index consisting out of two ordinal five-point Likert scales treated as equidistant), Cronbach's alpha = 0.67, M = 3.48, SD = 1.21 **Q1:** *If I consume les meat, I feel satisfied. (disagree 5 to agree 1, rotated)* **Q2:** *If I consume meat, I feel guilty. (disagree 1 to agree 5)*
Problem-awareness	Ratio (1 ordinal five-point Likert scale treated as equidistant), M = 3.58, SD = 1.24 Q1: *Energy consumption in the production of meat is a problem – disagree (1) to agree (5)*

Whereas cognitive factors such as attitude, social norm, personal norm, emotions and problem-awareness are important in initiating the change process, behavioral factors such as PBC are important not only during the inactive phases (Ajzen, 1991; Bamberg, 2012), but also during the active phases (Prochaska et al., 1992; Lippke et al., 2007; Bamberg, 2013). Thus, cognitive factors are relevant in the inactive phases 1 and 2, while behavioral factors are relevant in all phases.

In addition to the socio-psychological factors, we also use socio-demographic variables, such as gender and education, as confounding variables. Based on previous findings, we assume that females and people with a higher education have a higher probability of belonging to a higher phase (e.g. De Boer et al., 2014; Hayley, Zinkiewicz, & Hardiman, 2015).

Based on the theoretical and empirical background we have presented, the following socio-psychological factors are hypothesized to be predictors for the individual's affiliation to a certain phase.

H1 The higher the (positive) attitude, the higher the probability of belonging to phase 2 (relative to phase 1)

H2 The higher the social norm, the higher the probability of belonging to phase 2 (relative to phase 1)

H3 The higher the PBC, the higher the probability of belonging to phases 2, 3 and 4 (relative to phase 1)

H4 The higher the personal norm, the higher the probability of belonging to phase 2 (relative to phase 1)

H5 The higher the (negative) emotions, the higher the probability of belonging to phase 2 (relative to phase 1)

H6 The higher the problem-awareness, the higher the probability of belonging to phase 2 (relative to phase 1)

H7 The higher the level of education, the higher the probability of belonging to a higher phase (relative to phase 1)

H8 Females have a higher probability than males of belonging to a higher phase (relative to phase 1)

2. Methods

This article tests the influence of socio-psychological and socio-demographic factors within each of the four proposed phases of behavioral change. Based on quantitative data from a representative survey in the Swiss city of Lucerne, we use a multinomial logit (MNL) approach (see Greene, 2003) to test the hypotheses. The analysis tests whether or not the respondent is in phase 1 or some other phase (2, 3, or 4). In doing so, we detect factors for behavioral change for individuals with phase 1 affiliation (pre-decision).

2.1. Participants

The questionnaire was sent to 3500 randomly selected residents aged eighteen years or over in the medium-sized Swiss city of Lucerne. Respondents could complete the questionnaire either online or in a hard-copy version (mixed mode). A total of 1818 people responded, with 1585 completing the print questionnaire and 233 completing the online version. The response after data cleansing was 53 per cent, which can be considered high in comparison to other studies.

2.2. Questionnaire

Data for the research were based on a representative sample drawn from the register of Lucerne residents. Addresses were provided by the City Council of Lucerne. The survey was carried out between August and September 2015. The questionnaire contained questions regarding energy consumption and the savings behavior of Lucerne residents in various domains, including meat consumption. The participants were asked at what phase of the behavioral change process they would place themselves (self-statement items): "I have never considered reducing my meat consumption" (phase 1); "I've considered reducing my meat consumption, but I haven't yet put this plan into practice" (phase 2); "I make sure I consume less meat occasionally. In the future it is my firm intention to do this on a regular basis" (phase 3); "I take consuming little or no meat for granted" (phase 4). The operationalization of the four phases has been used in previous research (Bamberg, 2013) and has been adopted to the context of meat consumption in this article.

Respondents' attitudes, norms, perceived behavioral control, emotions and problem-awareness concerning a MRD were measured (for details, see Table 1). Respondents' general attitudes regarding environmentally responsible behavior and socio-demographic data were also collected. Questionnaire responses for socio-psychological factors

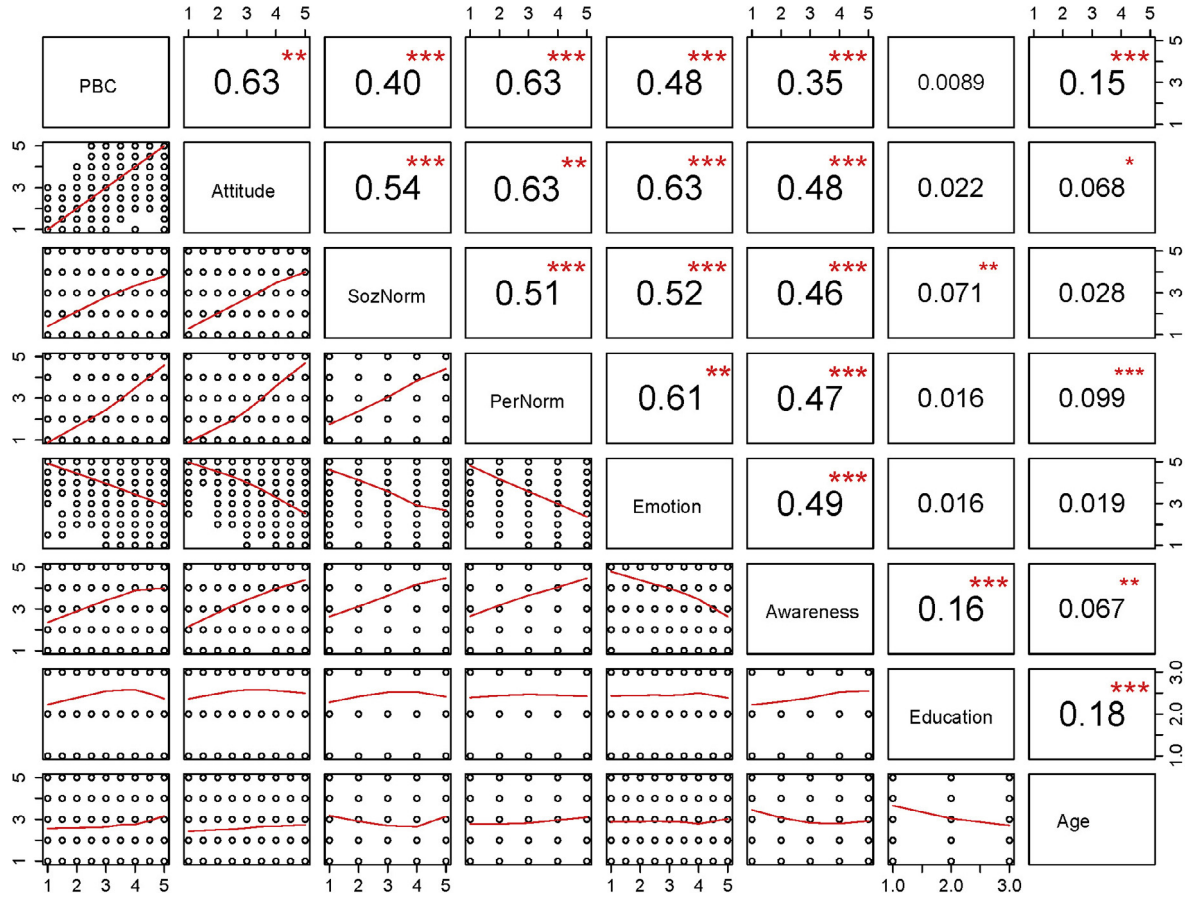

Fig. 1. Correlation matrix for independent variables.

were measured using a five-point Likert-scale (1 = strongly disagree to 5 = strongly agree). Finally, the questionnaire also included socio-demographic variables such as gender and education to be used in this modeling approach.

2.3. Multinomial logistic regression (MNL)

In line with the literature on PMA, we treat phase affiliation as a nominal dependent variable. Due to the dynamic process of behavioral change, which is not a rapid, unique event, but rather a process of possibly jumping over the phases and falling back again, it cannot be ordered meaningfully. Based on the empirical data from the city of Lucerne, multinomial logistic regression (MNL) is used to model nominal outcome variables. MNL is used to model choices and is a method of classification modeling with more than two possible discrete outcomes (see Greene, 2003). The model is able to predict the probabilities of the nominal outcome variables, given a set of explanatory variables. In detail, the effects relate to the probability of being in a higher phase relative to the probability of being in the first phase (the reference category).

In comparison to linear regressions, MNL is robust with regard to collinearity. MNL models the choice of K alternatives as a set of K-1 independent binary choices, in which one alternative is chosen as a reference category and the other K-1 compared to it. The log odds of the outcomes are modelled as a linear combination of the predictor variables. In this application, phase 1 is set as the reference category. Then, the log odds of preferring phases 2, 3 and 4 over phase 1 are calculated using the explanatory variables as predicted probabilities (P) for each phase by applying the exponent to the logarithmic function (ln). Based on this, the stated hypothesis can be tested. In this application, we can formulate the log odds as follows:

Moreover, socio-demographics were added to these equations as confounding control variables and to test hypotheses H7 and H8. Thus, MNL is based on a linear prediction function that predicts market share from a set of weights that are linearly combined with the independent variables. As an example, a one-unit increase in an explanatory variable with a positive sign is associated with an increase in the log-odds of being in phase 2 instead of phase 1 in the amount of the weight (b). The goal is then to predict which influential variable affects the phase affiliation in order to test the hypotheses that an increase in the socio-psychological factors increases phase affiliation, with phase 1 as a base line for the modeling. For reasons of better interpretation, probability plots for simulations will be presented in order to see how the market shares of phase affiliation are changed by the effects of the socio-demographic and socio-psychological factors. This provides the groundwork for formulating pointers of interventions promoting MRD.

2.4. Operationalization of explanatory variables

Table 1 presents the operationalization of variables. Bamberg (2013) served as the basis for the formulation items in the questionnaire that were adapted to meat consumption. These items have theoretical relevance and established validity in the research context of sustainability research.

The phases of the Self-Regulation Model were measured using four items. These items have been used in previous research to assess phase membership (Bamberg, 2013) and have been adapted to the context of a MRD in this article. Attitudes, personal norms, social norms, perceived behavioral control, emotions and problem-awareness regarding a MRD were measured using statement items. All items have been used in previous research to measure theses variables (e.g. Harland et al., 1999; Bamberg, 2013; Kaiser & Gutscher, 2003) and have been adapted

to the context of this study. All the measurement items were operationalized as a five-point Likert-type scale. In addition, the questionnaire included questions on sociodemographic variables (gender, education, and age).

2.5. Data analysis

First, the data were analyzed using descriptive measures and correlation analysis to present sample characteristics. In order to control for multicollinearity, we calculated correlations between all metric predictors (social-psychological factors, age and education – treated as equidistant). The correlation matrix (Fig. 1) reveals that there is no correlation greater than Pearson r < 0.7. Therefore, we assume there is only a little multicollinearity. Thus, we do not have to omit an indicator from our model.

Secondly, MNL modelling was carried out to test the hypothesis detailed in a previous section of this paper. In testing the socio-demographic and socio-psychological factors in respect of phase affiliation, a multinomial logit regression was used using R Studio Statistical Software (Version 0.99.491). We used the *multinom* function from the *nnet* package to estimate the model. The model contained three socio-demographics as covariates and all the socio-psychological factors.

3. Results

Data provided by the 1818 respondents revealed that the demographic profile of respondents comprised 53% females and 47% males. In total, 11% of all respondents were between 18 and 25 years old. About a half (51%) also possessed post-secondary education. In total, 62% of respondents reported belonging to a middle annual gross household income group (meaning 4000–10,000 Swiss francs), while 20% were in the low and 18% in the higher annual income categories. In contrast to the official census for the city of Lucerne, residents who were not Swiss nationals tend to be under-represented in the survey (16% instead of 24%). The sample is characterized by a high level of education. The tertiary education sector is significantly over-represented (51% instead of 42%), and those with only primary education tend to be under-represented (12% instead of 20%). There is a weak tendency to over-represent women in the sample. Due to the application of multivariate (variance) statistics, there is no need to re-weight the data given these relatively small deviations from the official census.

The descriptive statistics for the socio-psychological factors in Table 1 generally reveal the following. On average respondents reported a high attitude (M = 3.64, SD = 1.21). They also indicated a moderate social norm (M = 3.10, SD = 1.43) and a similarly moderate personal norm (M = 3.18, SD = 1.53) and emotion (M = 3.48, SD = 1.21). Respondents also reported a somewhat higher PBC (M = 3.84, SD = 1.24). On average, respondents have a moderate level of problem-awareness (M = 3.58, SD = 1.24).

Table 2 displays the means and standard deviations of the socio-psychological factors involved in each phase of behavioral change. The results indicates level effects based on differentiating the means of the socio-psychological factors according to the phase affiliation. A comparison of means between the different phases reveals significant differences with regard to all the socio-psychological factors. ANOVAs are used to determine the statistical relevance of the differences. The bivariate results reveal that all the socio-psychological factors vary significantly with the phases of behavioral change.

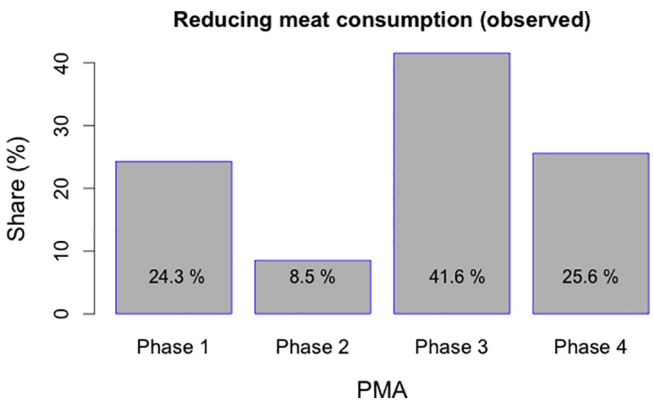

Fig. 2. Shares for affiliation in the phase model of action.

The shares of phase affiliation are as follows (see Fig. 2). 24.3% of the residents of Lucerne have never considered reducing meat consumption (phase 1). 8.5% considered reducing meat consumption and have already undertaken to do so, but have not yet put this plan into practice (phase 2). 41.5% make sure they consume less meat occasionally (phase 3). 25.7% take consuming little or no meat for granted (phase 4).

The final MNL analysis model results are summarized in Table 3.

Based on the final model, the following results emerged. The variables from the final model show a high pseudo-R^2 according to McFadden. McFadden pseudo-R^2 is the ratio of the likelihoods of the full model to the intercept model. Thus, this ratio can be interpreted as the proportion of the total variability explained by the model: the more variability that is explained, the better the model. $R^2 = 0.58$ can be considered high.

Attitude had a positive significant impact on all phase affiliations. For example, a one-unit increase in the attitude variable is associated with an increase in the log odds of being in phase 4 vs. phase 1 in the amount of $\beta = 2.18$ (t-value = 8.38, $p < .01$). Importantly, the log odds increase significantly as predicted between phases 2, 3 and 4. Thus, H1 can be confirmed partially since a positive *attitude* influences affiliation not only to phase 2 but also to phase 3 and 4 (with phase 1 as the reference category).

Our data reveal that there is only one significant impact on phase affiliations stemming from *social norm*: in phase 2, social norm had a significant impact on phase affiliation ($\beta = 0.43$, t-value = 3.54, $p < .01$). However, it had no significant influence on the other two phases, thus it only affects the change from phase 1 to phase 2. H2 can therefore be confirmed.

The higher the respondents' perceived behavioral control, the more

Table 2
Means of social-psychological factors along the phases of behavioral change.

Socio-psychological factors (ANOVA)	Phase 1		Phase 2		Phase 3		Phase 4		Total	
	M	(SD	M	(SD)	M	(SD)	M	(SD)	M	(SD)
Attitude (F = 526.93, df = 1710, p < .01)	2.2	*(1.0)*	3.0	*(0.8)*	4.0	*(0.8)*	4.7	*(0.6)*	3.6	*(1.3)*
Social norm (F = 118.78, df = 1710, p < .01)	2.1	*(1.3)*	3.2	*(1.2)*	3.3	*(1.3)*	3.7	*(1.4)*	3.2	*(1.4)*
PBC (F = 384.93, df = 1710, p < .01)	2.6	*(1.3)*	3.2	*(1.0)*	4.3	*(0.9)*	4.8	*(0.5)*	3.8	*(1.3)*
Personal norm (F = 675.32, df = 1710, p < .01)	1.6	*(1.0)*	2.4	*(1.1)*	3.5	*(1.2)*	4.5	*(1.0)*	3.2	*(1.5)*
Emotion (F = 228.98, df = 1710, p < .01)	2.6	*(1.3)*	3.4	*(1.1)*	3.7	*(0.9)*	4.6	*(0.7)*	3.5	*(1.3)*
Awareness (F = 169.53, df = 1710, p < .01)	2.6	*(1.1)*	3.6	*(1.1)*	3.8	*(1.1)*	4.2	*(1.0)*	3.6	*(1.2)*

Notes: M = Mean; SD = Standard Deviation, PBC = Perceived Behavioral Control.

Table 3
Multinomial logit results for 'Reducing meat consumption'

Variables	Phase 2				Phase 3				Phase 4			
	Coeff.	S.E.	t values		Coeff.	S.E.	t values		Coeff.	S.E.	t values	
Intercept Socio-psychological factors	−3.737	1.094	−3.417	**	−10.694	1.150	−9.300	**	−21.859	1.559	−14.017	**
Attitude	0.711	0.210	3.393	**	1.498	0.194	7.712	**	2.181	0.260	8.380	**
Social norm	0.428	0.121	3.540	**	0.013	0.106	0.124		−0.204	0.131	−1.555	
PBC	0.399	0.170	2.349	*	0.683	0.149	1.999	*	1.256	0.236	5.331	**
Personal norm	0.295	0.141	2.082	*	0.881	0.120	7.349	**	1.543	0.156	9.903	**
Emotion	0.381	0.156	2.439	*	0.201	0.146	1.374		0.291	0.159	1.830	
Problem-awareness	0.319	0.122	2.621	**	0.484	0.111	4.376	**	0.702	0.148	4.741	**
Education												
Low (ref.)	–	–	–		–	–	–		–	–	–	
Middle	0.684	0.476	1.438		1.975	0.442	4.470	**	2.146	0.560	3.830	**
High	1.110	0.468	2.373	*	2.341	0.441	5.306	**	2.803	0.555	5.049	**
Gender												
Male (ref.)	–	–	–		–	–	–		–	–	–	
Female	−0.104	0.252	−0.414		0.377	0.229	1.647		0.974	0.288	3.375	**
Age Categories (years)												
18–25 (ref.)	–	–	–		–	–	–		–	–	–	
26–40	0.286	0.395	0.725		0.188	0.398	0.473		0.469	0.520	0.903	
41–55	0.278	0.416	0.668		0.588	0.411	1.432		0.589	0.532	1.108	
56–70	0.003	0.503	0.007		0.987	0.456	2.163	*	1.282	0.579	2.216	*
70+	−0.885	0.856	−1.033		1.008	0.563	1.790		0.923	0.729	1.266	

Note: $^{**}p < 0.01$; $^{*}p < 0.05$.
R^2 (McFadden) = 0.58, Final log likelihood = 1890.181.
Observations (n) = 1'818, Coeff. = β Coefficients, S.E. = Standard error.

likely was their affiliation to phase 2 (β = 0.399, t-value = 2.349, p < .05), 3 (β = 0.683, t-value = 1.999, p < .05) and phase 4 (β = 1.256, t-value = 5.331, p < .01). The log odds indicate that the higher the PBC, the higher the probability of belonging to a higher phase. Thus, H3 can be confirmed.

The stronger the respondents' *personal norm*, the more likely were their affiliations to be to phase 2 (β = 0.30, t-value = 2.08, p < .05), phase 3 (β = 0.88, t-value = 7.35, p < .01) and phase 4 (β = 1.262, t-value = 5.33, p < .01). Like attitude and PBC, the log odds increase between phases 2, 3 and 4. Therefore, H4 can be confirmed partially because we expected an effect only in phase 2.

The construct of *emotion* has one significant effect on phase affiliation, and therefore H5 can only be confirmed partially (phase 1 vs. phase 2, β = 0.381, t-value = 2.44, p < .05). The higher the (negative) emotions, the more likely they are to be found in phase 2 instead of phase 1. This finding is in line with our hypothesis.

Problem-awareness had a positive significant impact on all phase affiliations. For example, a one-unit increase in the attitude variable is associated with an increase in the log odds of being in phase 4 vs. phase 1 in the amount of β = 0.70 (t-value = 4.74, p < .01). Like attitude and personal norm, the log odds increase as predicted between phase 2 (β = 0.32), 3 (β = 0.48) and 4 (β = 0.70) and phase 1 as the reference category. Since we predicted only an effect in phase 2, H6 can partially be confirmed.

The socio-demographic variables *gender* and *education* had a significant effect as well. A higher level of education was predictive of a higher phase affiliation. The higher the respondents' *education*, the more likely was their affiliation to phase 2 (β = 1.10, t-value = 2.37, p < .01), phase 3 (β = 2.34, t-value = 5.31, p < .01) and phase 4 (β = 2.80, t-value = 5.05, p < .01), with a low level of education as the reference category. In general, the higher the level of education, the higher the phase affiliation. Women were more likely to belong to phase 4 than men (β = 0.97, t-value = 3.381, p < .01). These results confirm hypotheses H7 and H8.

Given the same measurement level for all the socio-psychological factors, the effect sizes on phase affiliation with phase 1 as the reference category can be compared. With regard to phase 4, attitude, followed by personal norm, perceived behavioral control and problem–awareness, had the strongest effects. For phase 3 the same ranking applies. For phase 2, attitude makes the biggest difference, followed by social norm. This ranking is supported by probability plots. Based on the final model, four probability plots for phase affiliation are presented that have significant effects throughout all phases (attitude, PBC, personal norm, problem-awareness) in order to show the effect of the variables on phase affiliation in altering the levels of significant socio-psychological factors (Fig. 3).

Based on the simulations in Fig. 3, our modelling approach shows how the market shares of the four phases differ according to the socio-psychological effects in the survey population (city of Lucerne). It shows city authorities or campaign designer which socio-psychological factors have the most promising effects by targeting the interventions according to phases.

4. Discussion

This article contributes to the literature by highlighting a clear relationship between socio-psychological factors and phase models of behavioral change with regard to the issue of reducing meat intake. In line with previous findings, socio-psychological factors have an impact on the intention to undertake pro-environmental behavior or a MRD (e.g. Ajzen, 2002; Kaiser, Hubner, & Bogner, 2005; Garça, Oliveira, & Calheiros, 2015; Zur & Klöckner, 2014). The results provide factors for interventions to support a MRD. Based on the MNL approach, we can develop pointers for interventions, especially for those residents who have never considered reducing their meat consumption (phase 1, 24.3%, reference category of the MNL approach), in order to nudge them to a higher phase.

Our empirical findings suggest that the various socio-psychological factors affect the change to higher phases differently. In contrast to previous studies, which examined demographic and socio-psychological factors separately from the process of behavioral change, this article has applied a new approach by combining phase models of behavioral change with both socio-psychological factors and socio-demographic variables in the context of meat consumption.

This new approach helps identify relevant factors in each phase in order to influence people's meat consumption. After identifying in

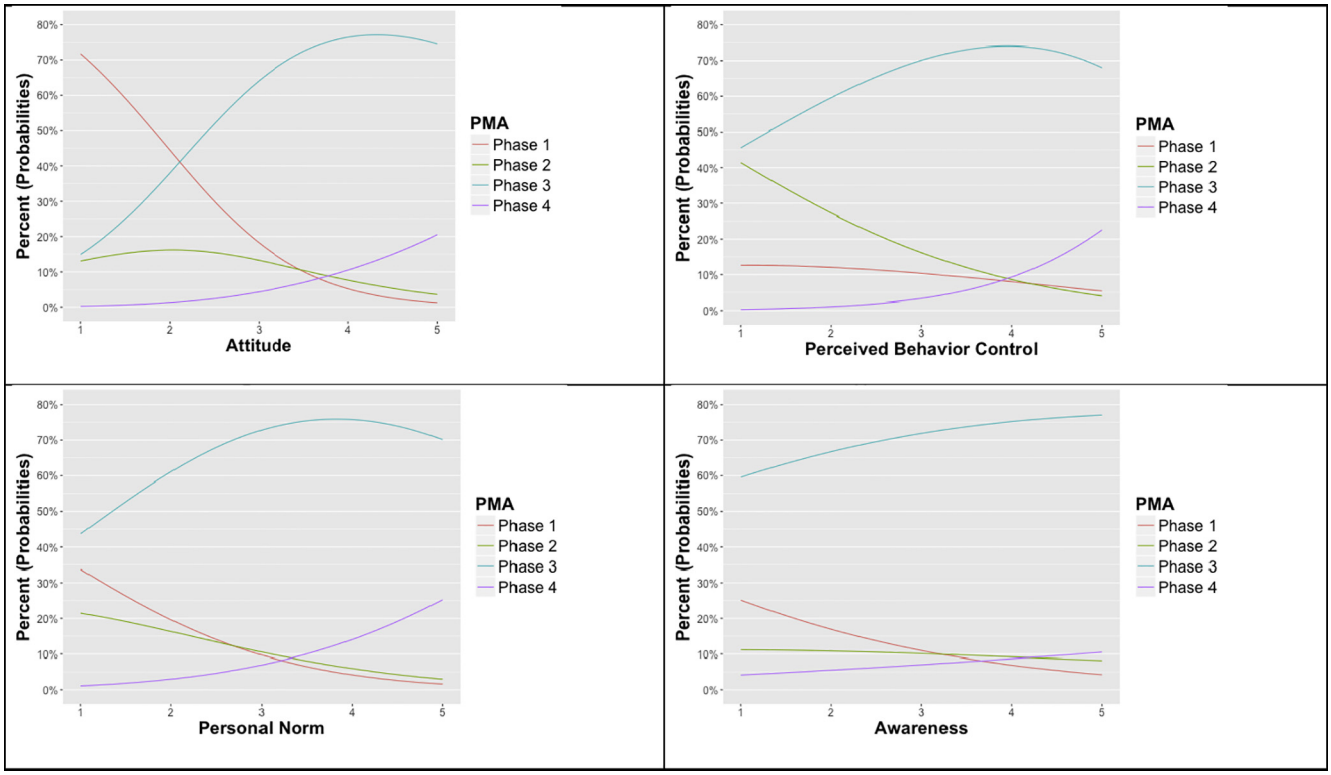

Fig. 3. Reducing meat consumption: socio-psychological effects on phases *Note*: All other variables are held constant at their mean when each of these market shares (probabilities) is calculated.

which phase consumers are, interventions can be tailored and implemented to change meat consumption. Thus, the phase model of behavior provides a practical tool to segment the consumer population based on their phase affiliation. Of course, identifying the relevant phase of an individual or a segment is not straightforward, as some form of market research is needed (e.g. surveys, socio-demographic approaches, lifestyle segments). However, we suggest that this segment-specific approach offers a more specific, efficient and tailored approach to inducing behavioral change than the usual approaches that target the population as a whole (the one-size-fits-all approach).

Our findings suggest that the following socio-psychological factors influence people's intentions to reduce their meat consumption: attitude, social norm, perceived behavior control, personal norm, emotion and problem-awareness. Importantly, the results of our study indicate that these socio-psychological factors are not relevant for all phases. For each factor relevant phases and potential measures are discussed.

4.1. Attitude

In contrast to the hypothesis, the results showed that the higher the attitude level, the higher the probability of belonging to a higher phase. Thus, attitude is a relevant factor in all phases. Lippke and colleagues (2007) found a similar pattern, showing that latent means of attitude were lowest in the first phase and highest in the last phase. It seems that increasing attitude is enforcing behavior (and/or vice versa) throughout the behavior change process.

Basically, there are emotion-based and knowledge-based strategies to influence attitude (please see Chapter 4.5 for emotion-based strategies). According to Ajzen (2002) declarative knowledge addressing beliefs is one of the background factors influencing attitude. In line with that finding, and based on the knowledge-attitude-behavior model (Kollmuss & Agyeman, 2002), the diffusion of declarative knowledge (e.g. how a MRD influences GHG emissions) might be a promising approach in helping to reduce meat consumption. This approach assumes a positive correlation between increased declarative knowledge and pro-environmental behavior. For instance, the population was rarely aware of the relationship between meat consumption and energy a decade ago. De Boer, de Witt, and Aiking (2016) showed that the effectiveness of consuming less meat as an option for climate change mitigation is currently recognized by 12% of their Dutch sample and 6% of their US sample. According to the knowledge-attitude-behavior model, declarative knowledge in the form of demonstrations of individual contributions (e.g., explaining the link between CO_2 emissions and meat consumption) has an influence on attitudes, which in turn is a lever for behavioral change.

4.2. Social norm

In addition, the present study highlights the importance of social factors when deciding whether to reduce meat consumption. Specifically, social norms have a significant impact in phase 2 but not in later phases. This finding supports the assumption that social norms have a motivating factor within the inactive phases of behavior change and thus could be of major importance in triggering a process of behavior change (Prochaska et al., 1992; Courneya, Plotnikoff, Hotz, & Birkett, 2001; Lippke et al., 2007; Bamberg, 2013). Those who did not think about changing their behavior in the past might be influenced by others to do so and in turn think about behavior change (Lippke et al., 2007).

Strategies that address social norms include, for example, role models, opinion leaders and celebrities or (brand) ambassadors being asked to demonstrate that they have reduced their meat consumption in public or to inform the public about the advantages of living a meat-reduced lifestyle (Bamberg, 2013; Ohnmacht et al., 2017). Famous vegetarians who promote a MRD include, for example, Jim Jarmusch, Paul McCartney and Thom Yorke. Thus, social norms may be addressed through normative communications that enable social learning from social reference groups or idols who produce standards for what is

viewed as right or wrong (Abrahamse, Steg, Vlek, & Rothengatter, 2005; Litvine & Wüstenhagen, 2011).

4.3. Perceived behavioral control

Our results suggest that high PBC scores are related to a higher probability for a phase 2, 3 or 4 affiliation, with phase 1 as the reference category. This finding is in line with previous research (Ajzen, 1991; Prochaska et al., 1992; Lippke et al., 2007; Bamberg, 2012, 2013).

Reducing people's perceptions of the difficulties of performing a given behavior such as reducing meat consumption is thus an important factor in encouraging behavioral change to curtail meat intake. One way to strengthen an individual's behavioral control is by decreasing the perceived difficulty of reducing personal meat intake. An example of an intervention aimed exactly at this variable is 'Meatless Monday'. This initiative was launched in 2003 in the United States and is now active in more than 44 countries worldwide (The Johns Hopkins Meatless Monday Project, 2017). It not only provides information about healthy and environmentally friendly meals, it also supports people in reducing their meat intake by, for example, suggesting recipes. Increasing the variability, availability and familiarity of vegetarian foods may help to increase perceived behavioral control (see Zur & Klöckner, 2014).

4.4. Personal norm

According to our results, the higher the personal norm, the higher the probability of belonging to a higher phase with phase 1 as the reference category. This finding supports the notion that addressing people's personal norms can be an effective strategy in reducing meat consumption and motivating people in such a way that they move to a higher phase within our proposed phase model.

Normative persuasion or communication with arguments concerning social norms and values could be an effective way to support a reduction in meat intake (Ohnmacht et al., 2017). For example, local authorities or NGOs might address altruistic or environmental motives through their communication activities. Counteracting moral disengagement with regard to one's meat consumption might be another communication strategy to reduce meat intake (Garça, Oliveira, & Calheiros, 2015). Moral disengagement might be a way to reduce cognitive dissonance (Festinger, 1957): most people do not want animals to suffer, but they nevertheless eat meat that requires animals to be killed and mostly to suffer (e.g. Herzog, 2010). Loughnan and colleagues (2014) call this phenomenon the 'meat paradox'. New framings of meat-eating habits, breaking with pro-meat arguments, may thus serve as a potential strategy for reducing meat consumption; for example, "there are healthy and nutritional valuable alternatives to meat" or "meat is not necessary" (Garça et al., 2015). In addition, Zur and Klöckner (2014) found that reduction intentions could be predicted by moral beliefs. Thus, focusing on one's personal obligations may be an effective way to reduce meat consumption (Harland et al., 1999).

4.5. Emotions

Emotions positively influence the behavioral intentions of individuals who have so far not thought of reducing their meat consumption. Thus, emotions significantly influence phase change from phase 1 to phase 2 (pre-action phase). However, they seem not to influence phase change to phase 3 and phase 4. This is in line with recent research in environmental psychology claiming that greater attention should be paid to emotional and social determinants (Gifford, 2014). In a similar vein, our research adds to a newer stream in environmental psychology that underlines the importance of emotions in order to promote pro-environmental behavior (Schaffner et al., 2015; Steg & Vlek, 2009; Wehrli, Priskin, Schaffner, Schwarz, & Stettler, 2014). Hence, marketing strategies that that try to evoke negative emotions such as guilt (for eating meat) or positive emotions such as satisfaction (for reducing meat consumption) might be an effective strategy with which to target people in phase 1.

Like the impact of social norms in the inactive phases of behavior change, emotions also seem to have a motivating factor within the early phases of behavior change (Prochaska et al., 1992; Lippke et al., 2007). Thus, based on our findings, we must assume that campaigns that address emotions are only effective for those who have not yet thought about meat reduction (phase 1).

4.6. Problem-awareness

Like attitude, perceived behavioral control and personal norm, high scores for problem-awareness were predictive of belonging to a higher phase. There are different strategies for increasing awareness of the consequences of meat consumption. Importantly, declarative knowledge increases awareness of the negative consequences of certain behaviors (Frick, Kaiser, & Wilson, 2004; Ohnmacht et al., 2017), such as meat consumption. For example, Carlsson-Kanyama and Faist (2009) discuss the idea of informing people about the environmental impact of their consumption decisions by providing green consumer guides. Hertwich (2005) suggested that calculators for environmental impacts could be helpful in achieving that aim (see, e.g., carbonfootprint.com). That is, showing people the link between CO_2 emissions and meat consumption or calculating the energy footprint of an average individual in a society compared with the population of emerging markets or the mean of a community/city might be helpful in demonstrating the individual's contribution to climate change. However, climate change mitigation (or energy-saving) is not the focal goal of consumers when they are buying or consuming food (De Boer et al., 2016). Furthermore, the complexity of the links between meat-eating and, for example, climate change should not be underestimated. The issues are complex and may even be contradictory. Thus, communicating information about such links appears to be a challenge even for science education (Skamp, Boyes, & Stanisstreet, 2013). For instance, purchasing organic meat may have environmental benefits, but it may also have negative impacts on climate change (Saxe, 2014). Such issues require extensive communication with consumers (De Boer et al., 2016). Furthermore, discussions regarding reductions of CO_2 emissions and meat must stress that meat-eaters tend to be much slower to recognize the negative effects of their consumption than other consumers (De Boer et al., 2016).

4.7. Gender and education

Women were more likely to belong to phase 4 than men. This result is congruent with the finding that women are more likely than men to have a positive attitude towards reducing meat consumption (Hayley et al., 2015). Thus, women in general might be more susceptible to communication measures that aim at promoting a meat-reduced diet.

A higher level of education was predictive of belonging to a higher phase. This result converges with the finding that people with a higher level of education are more likely to voice environmental concerns and have more knowledge about environmental issues (Kollmuss & Agyeman, 2002). Based on the knowledge-attitude-behavior model (Kollmuss & Agyeman, 2002), the same measures apply as described above for problem-awareness, such as informing people about the environmental impacts of meat consumption. In general, empowering people through education can have a positive effect on strengthening "adaptive capacity amidst the challenges of a changing climate" (Muttarak & Lutz, 2014, p. 42).

4.8. Conclusion

This study has provided a deeper understanding of the socio-psychological factors that influence reductions in meat consumption. It

contributes to the literature by showing the relationship between socio-psychological factors and the phase model of behavioral change. The most influential factors for a MRD are attitude, personal norm, perceived behavior control and problem-awareness. These factors are relevant in all four phases throughout the behavioral change process towards a MRD. By contrast, emotions and social norm seem relevant to initiate the change process and thus had an impact during the inactive phases 1 and 2. We focused mainly on the factors that alter phase 1 affiliation. If people in phase 1 are the target group, the factors described above are also the most promising factors for behavioral change.

We should note some limitations of the current study. It was conducted in a medium-sized city in Switzerland, an affluent society with post-materialist types of value, where eating meat is not necessarily related to wealth. Future research is needed to confirm the relationships the study revealed for those who live in more rural areas or individuals from other cultural backgrounds. Furthermore, we measured behavior based on self-reported measures, not actual behavior.

For practical reasons and due to the requirements laid down by the city council to limit the time permitted to fill out the questionnaire, we administered single- and double-item scales to measure the relevant constructs of the study. This might have impaired the validity of the measures. However, we try to limit this potential effect by (a) using measures that have been used in previous research, and (b) focusing on the items with the highest factor loadings if the relevant studies used more items than we did.

Finally, the conclusions drawn from this study may contribute to an increased understanding of the effectiveness of intervention strategies and may help decision-makers in the food sector decide how to design interventions and policies that promote reduced meat consumption. Tailored interventions that are linked to phases of behavioral change could help to improve the effectiveness of national and communal strategies to mitigate climate change that are often mass, one-size-fits-all campaigns.

5. Disclosure statement

The authors have no potential conflicts of interest to report.

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